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Commentary

Asbestos Fibers in the Colonic Wall

by G. E. Westlake*

As part of a long-term study, rats were fed a standard diet consisting of 65% cellulose, some casein, and a salt mix together with 6% of fairly pure chrysotile. After 3 months on this diet some of the rats were sacrificed and their colonic mucosa examined with the electron microscope. Two types of fixation were used: potassium permanganate and osmium. The permanganate gives very little cellular detail, but this is ideal in scanning large numbers of fields for asbestos fibers. The small chrysotile particles were easily distinguished by the typical concentric double tubule structure.

These particles were found in the mucus of the goblet cells, within the cytoplasm of the epithelial cells, and down into the smooth muscle layers. We tried to eliminate the possibility of these findings being artifacts. Many of the fibers appeared in seciton, indicating that they had been embedded in the tissue at an angle to the knife and were genuine cell enclosures. To eliminate the possibility that fibers from the lumen of the gastrointestinal tract had been pushed into the section, we eliminated asbestos from the diet of other rats for 3 days, at which time no fibers could be found in the feces. Particles were still present in the tissues, although in smaller numbers, probably due to clearance processes. It was interesting to note that we could find no membrane surrounding the fibers in the cells; the fibers did not appear to be situated in lysosomes or phagosomes. This is in line with another study that we performed, looking at phagocytes with asbestos, in which some of the fibers appeared to be in the cytoplasm and not bounded by a membrane. Continued observation of the surviving rats did not reveal the development of any tumors.

In another experiment we placed pellets of chrysotile in the pleural space of rats. After some months the pellets were organized by fibroblasts and invaded by histiocytes. Within the histiocytes we found phagocytic vacuoles containing asbestos. We also found that the characteristic structure of the chrysotile changed gradually, becoming amorphous. We postulated that some of the magnesium or silicate had been removed. We checked this by putting some chrysotile in an acid medium and found that there was leaching when the fibers were examined by the electron microscope. With appropriate staining methods we concluded that chrysotile can be broken down in lysosomes with the formation of polysilicic acids.

*Children's Hospital, San Francisco, California.